DOCUMENT RESUME

ED 122 682 HE 007 682

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TITLE Resource Management and Financial Equilibrium.
INSTITUTION National Association of Coll. and Univ. Business Officers, Washington, D.C.
PUB DATE Oct 75
NOTE 8p.
AVAILABLE FROM NACUBO, One Dupont Circle, Suite 510, Washington, D.C. 20036
JOURNAL CIT NACUBO Professional File; v7 n7 p1-7 Oct 1975

EDRS PRICE MF-$0.83 Plus Postage. HC Not Available from EDRS.
DESCRIPTORS Budgeting; Decision Making; *Educational Finance; Educational Planning; Enrollment Rate; *Financial Needs; *Higher Education; Income; *Models; Operations Research; Program Planning; *Resource Allocations; Tuition; Universities

ABSTRACT

The critical importance of planning in higher education is addressed. The challenge to planning is seen not just as alleviating the current pressures, but in assuring that the traditions of independence, creativity, and intellectual excellence survive. The planning process at Stanford University is described. For the university, the process of years of decentralization and incremental budgeting was effective in developing teaching and research programs of high quality but also generated "organizational slack." Planning models were developed to deal with financial matters such as tuition, enrollment, payout from endowment, budget size, and deficit or surplus size. The approach used concentrates on the growth rates of the components of income and expense, and a critical concept is that of long-run financial equilibrium. Methods for applying the model are outlined, and reasons for its impact considered. Its implications regarding centralized financial and institutional planning, ecology of the institution, and participation in planning and decision making by the faculty and others are discussed. (LBH)

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Resource Management and Financial Equilibrium

by William F. Massy

The critical importance of planning in higher education never has been more clearly manifest. This is a time of great financial pressure — perhaps unprecedented — on colleges and universities. More important, it is a time of threat to some basic academic values; some would say the viability of the academic enterprise itself is at stake. The challenge to planning is not just to alleviate the current pressures, but to assure that the traditions of independence, creativity, and intellectual excellence survive, if not prosper, during the years ahead.

Objections Raised to Planning

Until fairly recently the concept of planning in an activist role by the central administration of a university was viewed as unnatural, if not suspect. Although that attitude is beginning to change, considerable apprehension still exists in regard to centralized planning. Among the objections raised about planning and the application of analytical tools to academic administration are the following:

1. Centralized planning is dangerous because it takes the initiative away from those best able to exercise it — the faculty, department chairmen, and the deans of individual schools. There is fear that authority will be exercised by the wrong people. Even if the process is highly participative, the hoops and hurdles of a formal planning process may tend to drive out academic creativity and judgment in a Gresham's Law kind of way.

2. Detailed and scientific modeling schemes that often are associated with centralized planning will make it difficult for profound but qualitative judgments to make themselves felt. A short quotation illustrates the point:

> The success which this elegant model has had . . . is matched only by its failure to predict correctly the actual course of events — a fine illustration of the . . . maxim that a model is never defeated by facts, however damaging, but only by another model.

This argument takes force from the fact that the most important judgments an academic institution has to make are value-laden and qualitative. Models used indiscriminately represent unfair and undesirable competition.

3. "Planning doesn't work anyway. We've been planning for five years and look at the mess we're in now!" This view is not necessarily irrational. In a highly uncertain world it may be better to design a control system that relies on prompt response to feedback than to try to preprogram events through detailed planning. In addition, there are real and to some extent justified threats to the credibility of higher education administrators and the planning process they try to lead. An important question is whether imperfect planning leads to more or less stability and predictability of expenditures than periodic reaction to environmental events.

Other, less reasonable, objections also are raised in opposition to the application of planning principles in higher education. These may stem from an inherent mistrust of administration or administrators, a desire to preserve the status quo by "stonewalling" or "do nothingism," or from simple ignorance or misunderstanding about planning principles or the specific problems facing an institution. Where these are dominant they are hardly a credit to academic values and traditions. However, they should not be confused with the manifestation of differing values and judgments pursued vigorously and in good faith, which make any process of university decision making an intense experience.

Planning, as this article defines it, was not really necessary as long as the resources available to higher education were abundant and growing. The idea of reexamining the base budget in a formal multi-year context was seriously introduced at Stanford University only five years ago. Prior to that time the planning process was incremental, relatively informal, and highly decentralized.

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For Stanford, the process of years of decentralization and incremental budgeting was extraordinarily effective in developing teaching and research programs of very high quality. Academic effectiveness clearly can be enhanced or even maximized this way. But the process also generated what has been termed "organizational slack." The evidence for this is that since 1970 the institution has cut some $8 million out of the budget base with little serious effect on academic programs. These cuts have come from both the administration and the academic departments; the central question is how much more can be done without more dramatic and serious consequences.

It seems clear that higher education must be concerned with *efficiency* as well as effectiveness in the years to come. That's the essence of the current stress on accountability to state and federal funding sources, to students who pay tuition, to donors, and even to those who administer the institution. Higher education has become too large a user of society's resources to expect different treatment, especially in a time of diminishing enrollments and increasing competition from other societal programs. The problem is to find a way to be reasonably efficient without sacrificing overall effectiveness, especially on the nonquantitative dimensions that are essential to the mission of higher education.

The Purpose of the Models

Staff members at Stanford University have been working hard to develop planning processes and models that meet such challenges. Following is a discussion of the models, some of the implications that may be drawn from them, and the process by which they have come to have a certain amount of influence at Stanford.

The models may first be explained by stating what they are *not* designed to do. They do not say what programs should be strengthened, retained, or reduced in scope. They do not indicate where to find "slack" in administration or elsewhere. They do not even indicate what tuition to charge, how many students to admit, what the right payout from endowment ought to be, how large the budget should be, or how large a deficit or surplus ought to be run in a given year. They *do* provide some practical guidance on the latter set of issues. And by so doing, they make possible greater participation in the planning process by members of the institution, and provide a useful input to the more detailed and qualitative aspects of faculty and staff planning.

The approach used concentrates on the *growth rates* of the components of income and expense. Figure 1 lists some of these components and suggests some of the things that can be done to effect their levels and rates of change.

On the expense side there are wage-driven costs, other cost-rise factors, and the need for quality improvements and new programs. On the income side there are payout from endowment and gifts in addition to tuition and other special items such as indirect cost recovery on sponsored projects. Analysis of Stanford's budget data reveals the magnitude of these costs in a given year. A combination of empirical analysis of multiyear cost histories plus economic reasoning can provide estimates of their growth rates.

Projection of the future growth rates of budget quantities is a risky business, but it must be done. Some results of the analysis are:

1. Since universities are labor-intensive institutions, costs must be expected to rise faster than the rate of inflation in the economy, even assuming no change in program quantity or quality.

2. Analysis of Stanford's 1974 operating budget into wage vs. inflation-driven components suggests the following approximation for cost-rise.[1]

   Cost-rise = Inflation rate + 0.75 × Real per capita income growth rate

3. For the period from 1966 through 1974, the annual cost rise as estimated by the above formula was 7.0 percent (2.1 percent in real terms).[2] This was 1.4 times the rate of inflation, and about 15 percent higher than the U.S. Office of Education higher education cost deflator.

4. During the same period Stanford's core operating budget grew at an annual rate of between about 7.9 and 8.8 percent. (The exact rate is difficult to determine because the operating budget definition was being extended to include previously nonbudgeted expenditures.) Since the number of students remained virtually constant during these eight years, quality and/or declining productivity were being funded at an annual rate of between 1 and 2 percent. For four years during the same period the budget adjustment program (BAP) was eliminating specific expenditures totaling about 1½ percent of the operating budget each year.

The estimation of budget growth rates represents a refinement of the work started by William G. Bowen in 1968.[3] *The methodology used urgently needs to be developed further and applied to data for a broad cross section of institutions.* This will not only lead to a better understanding of cost-rise factors, but also will allow these models to be applied broadly and in a comparative context.

A critical concept in the modeling work is the concept of *long-run financial equilibrium.* Simply stated, a budget

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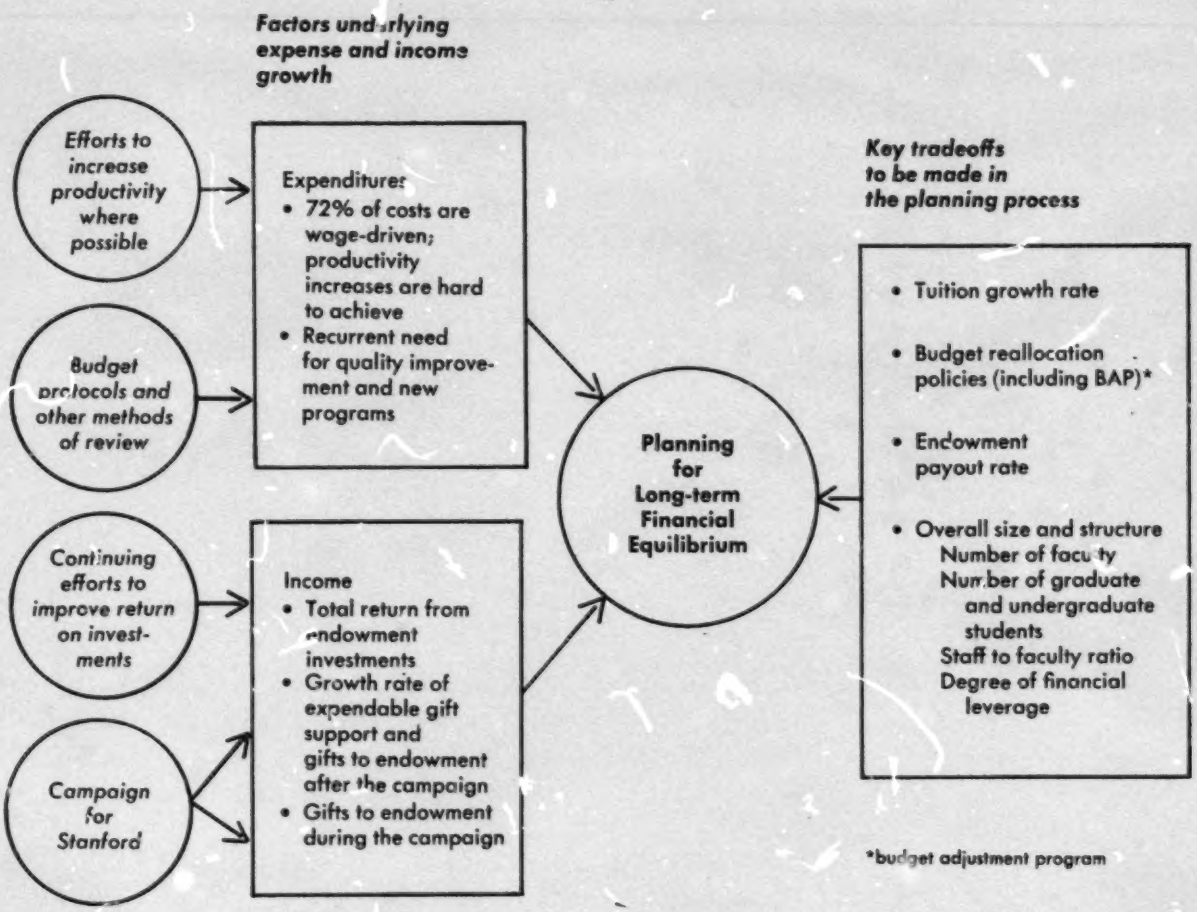
[1] For inflation, the GNP implicit price deflator is used.
[2] The GNP price deflator grew at an annual rate of 4.9 percent on a university fiscal year basis. Real per capita income grew at about 2.7 percent per year.
[3] William G. Bowen, *The Economics of Major Private Universities.* (Berkeley, California: The Carnegie Commission on Higher Education, 1968.)

Figure 1

Outline of Long-range Financial Planning System


Factors underlying expense and income growth
Efforts to increase productivity where possible
Budget protocols and other methods of review
Continuing efforts to improve return on investments
Campaign for Stanford
Expenditures
• 72% of costs are wage-driven; productivity increases are hard to achieve
• Recurrent need for quality improvement and new programs
Income
• Total return from endowment investments
• Growth rate of expendable gift support and gifts to endowment after the campaign
• Gifts to endowment during the campaign
Planning for Long-term Financial Equilibrium
Key tradeoffs to be made in the planning process
• Tuition growth rate
• Budget reallocation policies (including BAP)*
• Endowment payout rate
• Overall size and structure
Number of faculty
Number of graduate and undergraduate students
Staff to faculty ratio
Degree of financial leverage
*budget adjustment program

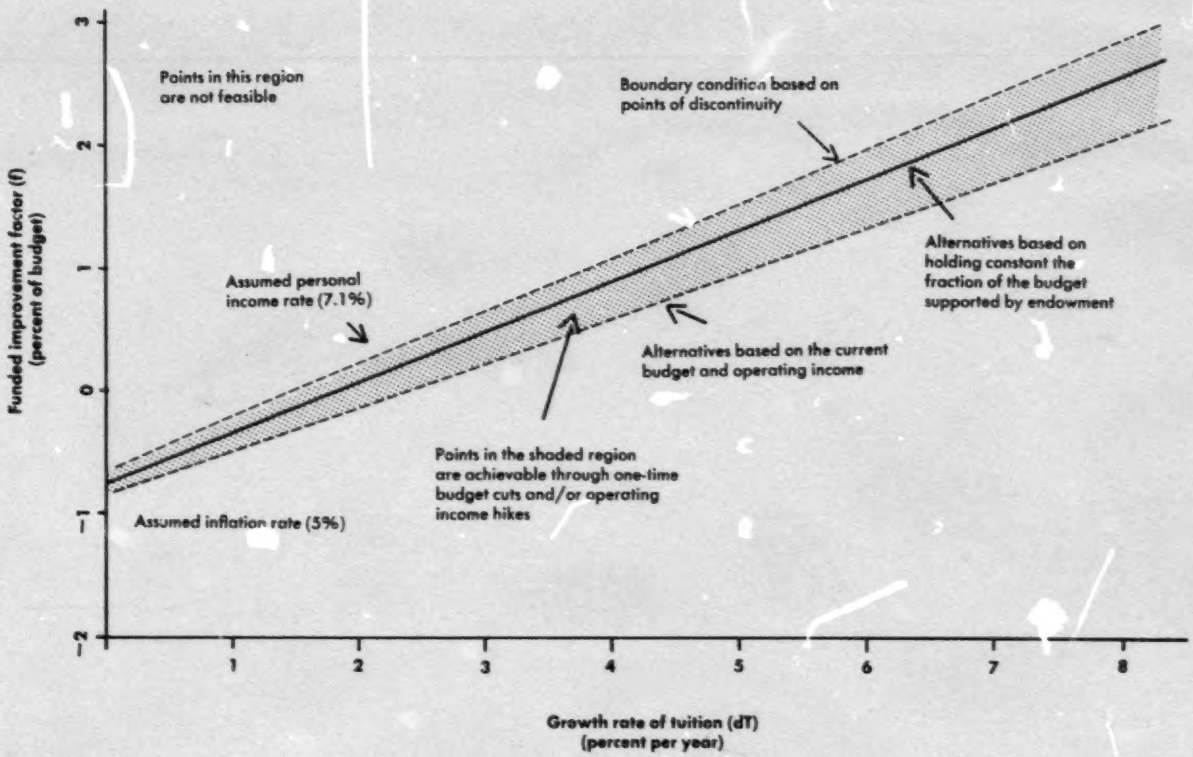
that is in "equilibrium" is one for which income equals expense in the current (base) year *and* the overall growth rates of income and expense are equal. Making explicit estimates of long-range growth rates and bringing them into the planning process is one possible way of avoiding the tendency to deal with budget imbalances by making short-term "fixes" that may mask real problems or make things worse in the long run.

A number of key tradeoffs are highlighted if long-run financial equilibrium is thought of as a constraint on the planning process. These include the tuition growth rate, the amount of budget reallocation (reductions in program to make funds available for new ventures), endowment payout, and possible changes in the institution's size and structure. The notion of a tradeoff is critical; when an item is "pushed in" somewhere in the system the requirement for balance of budget levels and growth rates causes something to be "pushed out" somewhere else. Quantification of such relations is a major objective of modeling.

One of the most important tradeoffs is illustrated by Figure 2. The growth rate of tuition, net of inflation, is plotted on the horizontal axis. On the vertical axis is the "net funded improvement factor." When multiplied by the previous year's budget, this determines the amount of new money that is made available for things like innovation, quality improvement, and the meeting of new demands for accountability or equity. In other words, the growth of the budget from one year to the next is the sum of necessary cost-rise on continuing programs plus "net funded improvement."

The solid line in the center of the figure implies that a little more than 2 percent real growth in tuition will be necessary even if no net funded improvement is allowed. (Change is still possible if funds are reallocated away

Figure 2 Tradeoffs Between Tuition Growth Rate And Funded Improvement


Points in this region are not feasible
Boundary condition based on points of discontinuity
Alternatives based on holding constant the fraction of the budget supported by endowment
Assumed personal income rate (7.1%)
Alternatives based on the current budget and operating income
Points in the shaded region are achievable through one-time budget cuts and/or operating income hikes
Assumed inflation rate (5%)
Funded improvement factor (f) (percent of budget)
Growth rate of tuition (dT) (percent per year)

from old programs each year.) This is close to the growth rate projected for real personal disposable income per capita, and is about the minimum increase in tuition that can be expected in the private sector of higher education, given currently envisioned conditions. Should a 1 percent net funded improvement factor be necessary for institutional viability, a tuition growth rate of nearly twice that of real personal disposable income per capita would be required.

Stanford's real tuition growth rate was 4.1 percent during the period from 1966 to 1974. This is consistent with a net funded improvement factor of a little over 1 percent. (The actual funded improvement factor is estimated at between 1 and 2 percent during these years, implying that other sources of funds were supplanting tuition to some extent.) Gross funded improvement (including budget adjustment program reallocations) averaged between 2½ and 3½ percent.

The solid line in the figure depends on another constraint, which is that the long-run financial equilibrium should be *stationary*, in the sense that the proportion of the budget supported by endowment should remain the same over time. (Other definitions of stationary equilibrium are also possible.) There is an "intergenerational equity" argument in favor of this requirement. It implies that the purchasing power of the endowment, defined in terms of the fraction of the total program of the institution that is supported, will be preserved. Future students will enjoy the same benefits from the endowment as do present ones, given stationary equilibrium.

Even if one does not accept the idea of stationary equilibrium, the upper line is the limit for the position of the tradeoff between tuition growth rate and funded improvement. It can be reached by budget reductions beyond those that might be necessary to achieve stationary equilibrium. However, it can be shown that points above and to the left of the upper line are not practical, regardless of the budget reduction attempted.

The implication of the long-run financial equilibrium model applied to Stanford data is that the "price" of private higher education surely will grow relative to the prices of other goods and services. Indeed, it probably will grow faster than the growth rate of average family income. For the public sector, increasing support at similar rates will be required from a combination of state funds and student fees. Despite the understandable concerns of students, parents, and those in state government, there appears to be no practical way of halting this upward trend in costs.

The long-run financial equilibrium model also has implications for the endowment payout rate. The model can be used to determine payout as a function of the type of equilibrium (whether it is stationary or not) and the funded improvement and tuition growth rate policies, as well as total return from investments and the flow of new gifts to endowment. It makes sense to set the endowment payout rate in the context of a spending-saving strategy rather than only on the basis of market performance measures such as total return or dividend and interest income.

For Stanford, it appears that a payout rate of between 4½ and 5 percent will be about right. This compares to 5½ percent that had been budgeted and approximately 7 percent scheduled to be paid out in fiscal year ended August 31, 1975, given the recent stock market decline.

Model for Transition of Budget

The last modeling application may be the most significant. This particular model, which was invented by David S. P. Hopkins, of Stanford's academic planning office, is a model for the transition of the university budget to equilibrium.

To see the significance of this model, it is important to consider the context in which it was developed. For some time prior to the summer of 1974, a combination of intuitive judgment, long-range financial projections, and the results of the model-building efforts described so far were signaling that Stanford would experience increasingly heavy financial weather. The evidence was hazy, but the several independent approaches seemed to be signaling the same thing. This culminated in the development of a detailed bottom-up, five-year financial forecast for the operating budget. Previously, ten-year projections of financial parameters had been used for the university's overall or "consolidated" budget. However, this was the first effort to develop a set of predictions that could be defended logically on an item-by-item basis and applied to the budget that determines general fund allocations. This forecast was completed during the summer of 1974; it showed annual deficits growing to about $22 million in 1979-80.

The problem could be attributed to a number of causes that were fairly clear in retrospect, but very difficult to have predicted in advance. They included inflation, decline in the stock market, and softening of government support. Also, some policies such as a too-high endowment payout rate and a too-low tuition increase for 1974-75 had contributed to the problem. The question in September 1974 was, "How much of a budget reduction would be necessary, and over what period of time could it be made?" Those responsible for budgeting asked the modelers, "How can you help—by next week?"

The "transition-to-equilibrium model," the main results of which are shown in Figure 3, provided an answer. The model starts from the detailed five-year financial forecast mentioned above, invokes constraint of stationary long-run financial equilibrium at the end of the forecast period, assumes a desired time distribution of gap-closing measures, and then solves a system of sixteen simultaneous linear equations. In addition to the yearly reductions that would be needed to achieve budget balance and equilibrium by 1979-80, the model estimates desired budget levels, endowment balances, and the deficits to be incurred each year on the way to equilibrium.

Figure 3 illustrates three of the many runs of the model made in the autumn of 1974. The middle curve suggests gap-closing measures totaling $10.2 million, to be achieved during a three-year period. This target was adopted and announced by President Richard W. Lyman at the October meeting of the board of trustees. In addition, the various presentations made to the board, the faculty senate, and other groups made heavy use of the five-year financial forecast and the transition-to-equilibrium model. President Lyman's Budget and Priorities Commission (composed of students and faculty as well as administrators) reviewed the reasoning—including the logic and applicability of the model—that led to the decision to set the "gap" at $10.2 million. Members concluded that there was a problem and that the target was reasonably correct.

Reasons for the Model's Impact

Here are some of the reasons why the model has had a substantial impact:

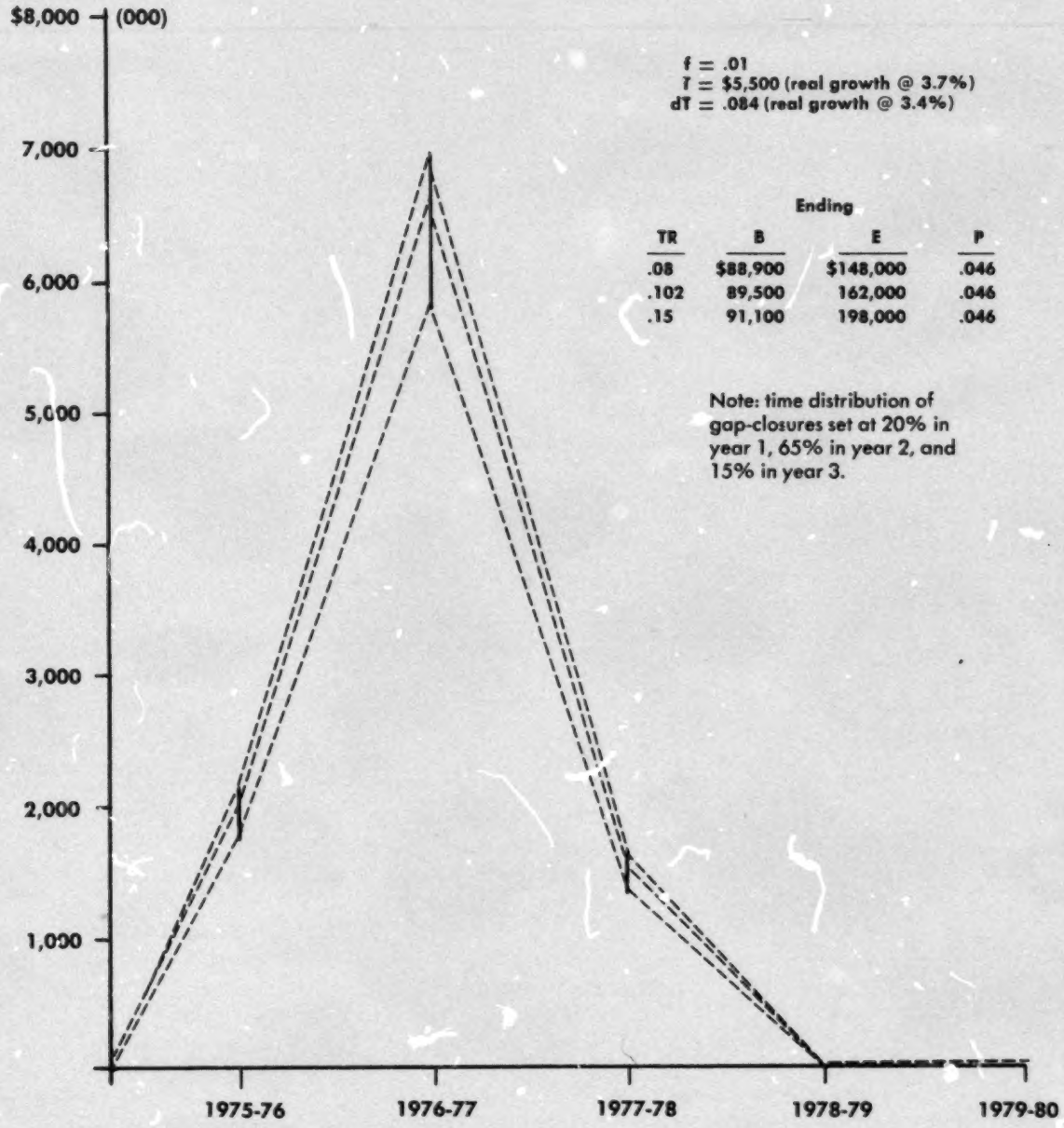
1. Long-run financial equilibrium is a useful construct that is understandable and has considerable appeal to common sense. From a technical standpoint, it provides a set of terminal conditions for what otherwise would be an infinite-horizon decision problem.

2. It was possible to establish a logical and explainable relation between the highly disaggregative bottom-up, five-year forecast and the gap-closing target that would bring about equilibrium. Without this link it would have been much more difficult to agree on a realistic target.

3. The model brought the funded improvement factor (set at 1 percent), the tuition growth rate, endowment payout, and other variables all together in the same conceptual package where the effect of tradeoffs could more easily be seen. For example, the effect of changes in tuition or funded improvement policies could easily be represented in terms of the "gap."

4. It is possible to do sensitivity analysis on key parameters. The most important one is illustrated in Figure 3. It rather conclusively demonstrates that the recovery in the stock market hoped for by many would not make the problem go away. Thus it eliminated from contention the argument that a strategy of "watching and waiting" might be better than a painful budget-balancing program.

Figure 3
Feasible Budget Reduction Schedules for Different Endowment Returns



f = .01
T = $5,500 (real growth @ 3.7%)
dT = .084 (real growth @ 3.4%)

	Ending		
TR	B	E	P
.08	$88,900	$148,000	.046
.102	89,500	162,000	.046
.15	91,100	198,000	.046

Note: time distribution of gap-closures set at 20% in year 1, 65% in year 2, and 15% in year 3.

Key:

f = funded improvement factor
T = tuition rate in 1979-80
dT = growth rate of tuition after 1979-80
$ = thousands of dollars

TR = total return on endowment, compounded annual rate to 1980
B = budget in 1980
E = endowment in 1980
P = endowment payout rate

5. Since it is easy to rerun the model when data change (currently a run costs about twenty-two cents), it is possible to track variations in forecasts, assumptions, and choices on the budget-balancing target. Since October 1974 the gap has migrated from $10.2 million up to more than $12 million and back down to between $9 and $10 million. Thus the budget-balancing program can be dynamic in the sense of being responsive to changing conditions and assumptions.

6. The model deals with a multiyear time horizon. Since the achieving of equilibrium is set at several years in the future, extreme short-term fluctuations should be damped out. This property will become particularly important as the model is run and rerun over a succession of years, with differing assumptions.

The significance of the model is demonstrated by the formation of a task force of the President's Budget and Priorities Commission to continue reviewing the evolution of the model, the assumptions that are going into it, and the results therefrom. This development is welcomed for many reasons, not the least of which is the expertise that will be brought to bear by faculty colleagues.

On the immediate agenda is the task of extending the transition model to accept uncertain parameter estimates and yield probability distributions for key budget quantities, including the gap. It is important for the risk involved in forecasts and calculations to become better understood, and the fact that results are subject to uncertainty should be communicated at every opportunity. This is particularly important in multiperiod planning, where a given year's target will be seen to fluctuate from cycle to cycle. Further steps, of a more basic research nature, include interesting control theory problems to be solved in the context of long-run financial equilibrium.

In summary, the attempt to apply models to the academic planning process at Stanford has resulted in the following points, which outweigh those made by the critics of planning and modeling that were quoted earlier.

1. Centralized financial and institutional planning is necessary because, in higher education, the commitments made to or decisions made by one academic unit can have a profound effect on other units. In other words, the institution must be viewed as an integrated whole and not as a heterogeneous collection of schools and departments. Global financial constraints must be well understood. Models can aid in looking at the institution as a whole. Indeed, they may be essential for accomplishing that purpose.

2. The ecology of a top-flight academic institution is relatively fragile. Bringing out the best of human intellect in teaching or research requires a hospitable and reasonably stable environment. At the same time, response must be made to changes in financial parameters and the external economic environment. Given this, the absence of effective planning means a high degree of reactivity, start-stop budgeting, and the probable erosion of morale and accomplishment. It has been seen that models can help in the process of developing multiyear plans. These can help stabilize the academic environment by curbing uncertainty and minimizing surprises.

3. Participation in planning and decision making by faculty and others is important. There are many wise heads in an institution—minds the administration can scarcely do without if the best possible decisions are to be taken. And participation may, in the long run, reduce the sense of frustration and mistrust that is sometimes apparent today. (This in itself would be a major benefit to academic institutions and to those who live and work in them.) If used correctly, models can enhance participation. If used wrongly, they can make the planning process even more obscure.

Effective decision making requires the marshaling of data in a way that enhances the opportunity for judgment. Effective participation requires in addition a shared set of concepts—a framework within which to interpret data and to debate assumptions and choices. Simple but relevant models can play a key role in furthering both objectives.

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